1.2.1 NPAC/SMS Architecture

The Industry has high expectations for immediate, secure, and available NPAC/SMS service in an environment of rapid change. Service Providers have come to expect the NPAC/SMS to operate to the same high standards of their critical network infrastructure and operations support systems.

Neustar has built our solution architecture in a modular fashion, through the efforts of our application engineers, network engineers, security engineers, database administrators, storage experts and operations staff. The solution is divided into five Layers described in this section. This allows our experts to focus on their specific area of responsibility, and allows changes to be delivered effectively and efficiently.

Neustar will continue to provide the Industry the highest levels of service they have come to expect. We will continue to improve the architecture solution to meet, exceed and anticipate the needs of the Industry as the communications landscape continues to evolve. Neustar designed the NPAC solution to be highly available, support high demand, be scalable and modular, and be highly secure. Table 1.2.1-1 demonstrates how we have architected the system to meet/exceed the requirements of the Industry.

Table 1.2.1-1. Meeting/Exceeding Industry Requirements

Requirement	Design
High availability	• Redundancy and survivability at all Layers of the architecture • Stable application software design and quality assurance processes • Robust operational practices • High quality and experienced engineering and operations staff • Platform testing at 4X production load • Automated failover processes to meet new SLR 1 requirements
[redacted]	Security-Related Information
Scalable and modular for new features and functionality	• Modular hardware and software design • Finely tuned hardware and software architecture • Layered architecture • Optional data fields
Security-Related Information	Security-Related Information [redacted]

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Monitoring, Staffing, and Processes

Preventative and predictive maintenance routines are performed weekly, monthly and/or annually based on manufacturer recommendations and Industry best practices Mechanical and Electrical system reactive and routine maintenance activities are performed using established Neustar processes and notification procedures as required. **Our continual forecast trending and analysis of capacities provide insight for predictive maintenance and future installation requirements.** Data Center personnel use Neustar cabling and labeling standards that have been developed using Industry best practices and then adapted for our unique applications and designs. We employ the use of a separate "build room" for testing, installing OS, and "burn in" of equipment before it hits the data center floor to reduce the potential for early equipment lifetime failures in production.

The Neustar Difference

Neustar has honed our competency across all areas within the Layer—data center location, security, internal mechanical, electrical, and fire suppression systems, staffing, and processes—to meet/exceed the specific requirements of the NPAC/SMS through our many years of actual operation of the U.S. LNPA service. Security-Related Informatic

As shown in Exhibit 1.2.1-2, Neustar's NPAC/SMS Security-Related Information has a proven, audited track record of exceeding and far exceeding Industry-best practices. Neustar's data centers continue to score well above "Industry Best Practices" and in many cases are best in class as highlighted in our 2012 annual operations audit (required by the NPAC Master Agreement) completed by a neutral third-party auditor. In addition, Neustar data centers are included in scope for numerous audits including Sarbanes-Oxley (SOX) and SSAE16 (formerly SAS70) without issue.

Data Center Environment–Article 14 Audit Scores

Category	2008	2012	Trend
Data Center Environment Overall	**4.60**	**4.67**	▲
Physical Space	4.40	4.40	⟷
General	4.20	4.20	⟷
Racks and Placement	4.50	4.50	⟷
Division of Space	4.20	4.20	⟷
Labeling and Marking	4.60	4.60	⟷
Documentation	4.50	4.50	⟷
Electrical Elements	4.50	4.70	▲
Backup Power Sources	5.00	5.00	⟷
HVAC and Air Handling	4.80	4.90	▲
Smoke Detection	4.80	4.80	⟷
Fire Protection	4.80	4.80	⟷
Water Detection	4.80	4.80	⟷
Facilities Modification	4.50	4.50	⟷
Facilities Inspection	4.80	4.80	⟷

5 - Excellent performance, far exceeds industry best practices
4 - Above average performance, generally exceeds industry best practices
3 - Average performance, meets industry best practices
2 - Below average performance, fails to meet industry best practices
1 - Poor performance, falls far below industry best practices

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Exhibit 1.2.1-2: Third-party audits validate our performance and provide valuable input on possible future enhancements.

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Network Infrastructure–Article 14 Audit Scores

Category	2009	2012	Trend
Network Architecture	**4.70**	**4.73**	▲
Documentation	4.70	4.70	⟷
Documentation Maintenance	4.50	4.50	⟷
Public Addresses	4.80	4.80	⟷
Private Addresses	4.90	4.90	⟷
IP Addresses Requests	4.80	4.80	⟷
DNS Architecture	4.60	4.60	⟷
Internet and Customer Connectivity	4.80	4.80	⟷
Network Monitoring	4.90	4.90	⟷
Handling Failures	4.60	4.60	⟷
High Availability	**4.60**	**4.68**	▲
WAN Access	4.60	4.60	⟷
Firewalls	[redacted]	[redacted]	⟷
VPN Concentrators	5.00	5.00	⟷
Routers and Router/Switches	4.60	4.70	▲
IOS/Hardware and Maintenance	**4.70**	**4.70**	⟷
IOS	4.60	4.60	⟷
Testing	4.60	4.60	⟷
Change Control	5.00	5.00	⟷
Out-of-Band Management	4.70	4.70	⟷
Emergency Maintenance	4.60	4.60	⟷
Hardware Inventory	4.50	4.70	▲
Ticketing Systems at Neustar	4.70	4.70	⟷
Customer Notification	4.50	4.70	▲

5 - Excellent performance, far exceeds industry best practices
4 - Above average performance, generally exceeds industry best practices
3 - Average performance, meets industry best practices
2 - Below average performance, fails to meet industry best practices
1 - Poor performance, falls far below industry best practices

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Exhibit 1.2.1-5: Third-party audits validate our performance and provide vauable input on possible future enhancements.

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The Neustar Difference

While the hardware described here is dedicated exclusively to the NPAC service, the exact same types of hardware are used for other applications within Neustar. This affords us extensive experience with these components outside of the NPAC operational environment. Consequently, our technical staff is well trained and very familiar with all the hardware components within the NPAC environment. All changes to NPAC infrastructure are first implemented within a different operational Neustar service. This way, changes are validated in a production environment before they are brought to the NPAC.

1.2.1.3.2 Four Layers of the NPAC/SMS Application Software

The NPAC/SMS Application is a very large and complex repository of application code. To help manage this complexity, the software itself is broken into the four different layers. Each layer provides a particular service or functionality within the system. Each layer is built on top of the previous layer.

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